Listed Water body: **Santa Maria River, Orcutt Creek and Oso Flaco Lake**

Listed Condition: **Pesticides** (DDT, dieldrin, endrin, and chlorpyrifos)

Designated Beneficial Uses for associated water bodies:

Santa Maria River
Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Service Supply (IND), Ground Water Recharge (GWR), Freshwater Replenishment (FRESH), Contact and Non-contact Recreation (REC-1 and REC-2), Wildlife Habitat (WILD), Cold Freshwater Habitat (COLD), Warm Freshwater Habitat (WARM), Migration of Aquatic Organisms (MIGR), Rare, Threatened or Endangered Species (RARE), and Commercial and Sport Fishing (COMM)

Santa Maria River Estuary
GWR, REC1, REC2, WILD, WARM, MIGR, Spawning, Reproduction, and/or Early Development (SPWN), Preservation of Biological Habitats of Special Significance (BIOL), Estuarine Habitat (EST), RARE, COMM, Shellfish Harvesting (SHELL).

Orcutt (Orcutt-Solomon) Creek
MUN, AGR, GWR, REC1, REC2, WILD, COLD, RARE, EST, FRESH, COMM.

Oso Flaco Creek
MUN, AGR, GWR, REC1, REC2 WILD, WARM, BIOL, RARE, FRESH, COMM

The designated beneficial uses identified as impaired due to elevated levels of pesticides are briefly described below.

Habitat-Related Uses (WARM, COLD, EST, WET, MAR, WILD, BIOL, RARE, MIGR, SPWN)
Several habitat-related beneficial uses include warm and cold freshwater habitats; estuarine, wetland and marine habitats; wildlife habitat; biological habitats (including Areas of Special Biological Significance); habitats that support rare, threatened, or endangered species; habitats that support migration of aquatic organisms; and habitats that support spawning, reproduction, and/or early development of fish.

Human Consumption of Aquatic Organisms (COMM; SHELL)
Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Recreational Uses (REC-1, REC-2)
Water Contact Recreation (REC-1) and Non-Contact Water Recreation (REC-2) are defined as uses of water for recreational activities involving body contact and proximity to water. Some of these activities include swimming and fishing, and where the ingestion of water is reasonably possible.

Pollutant(s) of concern: OC pesticides (aldrin, DDT, dieldrin, endrin, and toxaphene); OP pesticides (chlorpyrifos and diazinon); synthetic pyrethroid pesticides.

Watershed Location: Santa Barbara County and San Luis Obispo County, California

Water body name(s) and California water body identification number(s):
Santa Maria River and Oso Flaco Lake; Hydrologic Unit 312.01

Geographic extent of the potential water quality limited segment: the Santa Maria River from its confluence with Orcutt Creek to the mouth of the Santa Maria River estuary where it enters the Pacific Ocean; Oso Flaco watershed.

Year added to California's CWA Section 303(d) List of Impaired Waters:
Proposed in 2006

Staff Contact: Katie McNeill; 805 549-3336/ kmcneill@waterboards.ca.gov

CONTENTS

TABLES

FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Name
AETs	Apparent Effects Threshold
BPTCP	Bay Protection and Toxic Clean-up Program
CCAMP	Central Coast Ambient Monitoring Program
CCC	Criterion Continuous Concentration
CCoWS	Central Coast Watershed Studies at California State University, Monterey Bay
CDPR	California Department of Pesticide Regulation
CMC	Criterion Maximum Concentration
CTR	California Toxic Rule
EDL	Estimated Detection Limit
ELISA	Enzyme-linked immunosorbant assays
EPA	Environmental Protection Agency
ERLs	Effects Range Lows
ERMs	Effects Range Medians
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	Geographic Information System
IPM	Integrated Pest Management
LC50	Lethal Concentration
MEP	Maximum extent practicable
MS4s	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	Polynuclear aromatic hydrocarbons
PELs	Probable Effects Levels
PUR	Pesticide Use Report
QAPP	Quality Assurance Project Plan
REC-1	Water contact recreation
REC-2	Non-water contact recreation
SSO	Site-specific objective
SSURGO	Soil Survey Geographic
SWAMP	Surface Water Ambient Monitoring Program
SMW	State Muscle Watch
TCP	Toxic Cleanup Program
TELs	Threshold Effects Levels
TIEs	Toxicity Identification Evaluations
TMDL	Total Maximum Daily Load
TSM	Toxic Substances Monitoring
TTRLs	Threshold Tissue Residual Levels
TUs	Toxic Unit
UAA	Use Attainability Analysis
USFDA	Unites States Food and Drug Administration
USGS	United States Geologic Survey
VOCs	Volatile organic compounds
Water Board	Regional Water Quality Control Board (Region 3)
WDR	Waste Discharge Requirements
WWTP	Waste Water Treatment Plant

1. INTRODUCTION

The goal of the Project Definition is to outline a strategy for addressing one or more impaired waters. The Project Definition is used to develop an initial hypothesis of the factors causing the impairment and a strategy for the analysis and ultimate management approach (UAA, Total Maximum Daily Load, permit or other regulatory action).

The Project Definition defines the impairment based on the 303(d) listing, identifies the project area, recommends a management approach and identifies any key information or information needs to support the recommended management approach (e.g., major sources, stakeholders, management issues, regulatory issues).

The questions that staff addresses in this report are as follows:

- What is the impaired waterbody addressed? What are its major characteristics?
- What is the impairment? What is the pollutant of concern?
- Why was the water listed?
- What is the geographic setting of the impaired water?
- Are there major activities in the watershed that are known to be affected by (e.g., recreation) or exacerbated by the impairment (e.g., agricultural activities)?
- Are there any major management issues associated with the impairment or strategy?
- Are there any major technical issues associated with the impairment assessment?

The proposed listings include the following: DDT, dieldrin, endrin, and chlorpyrifos in the Santa Maria River; DDT, dieldrin, and chlorpyrifos in Orcutt Creek; and dieldrin in Oso Flaco Lake. This Project Definition includes an analysis of these constituents in these waterbodies along with other pesticides of concern in associated waterbodies.

Staff evaluated the watershed characteristics, listing basis, applicable water quality objective or criterion and potential numeric targets, available data, and project management components, including development of a recommended management strategy and a working hypothesis regarding the causes of the impairment. This Project Definition for the Santa Maria River Estuary Pesticides Project includes selected components of a Project Charter (from Project Management, 2006). The information contained in this report will be used to develop a Project Plan and subsequent documents to address the listings.

1.1. Watershed Description

The Santa Maria and Oso Flaco watersheds are located in Northwestern Santa Barbara County and Southwestern San Luis Obispo County, California. The watersheds are about 50 miles north of Point Conception and about 150 miles south of Monterey Bay on the central California coast. The climate is mild with 14 inches average rainfall a year. The watershed is characterized as having very low flows.

The area is a broad alluvial plain near the ocean, tapering gradually inland. Upland or mesa areas, foothills, and mountain complexes further define the alluvial plain boundary. Coarse-grained alluvial channel deposits in the river grade to finer silt and clay flood deposits as distance from the river channel increases.

The Santa Maria Valley groundwater basin extends south from the Nipomo Mesa to the Orcutt Uplands. The Santa Maria groundwater basin is divided into five sub-basins: the Santa Maria, Orcutt, Nipomo, and Upper and Lower Guadalupe sub-basins. The Upper Guadalupe sub-basin constitutes the upper unconfined portion of the sub-basin and the Lower-Guadalupe is a deeper confined aquifer separated from the upper sub-basin by clay layers.

The land uses are a mosaic of rangeland, irrigated agriculture, and urban areas.

Major watersheds are shown in Figure 1.

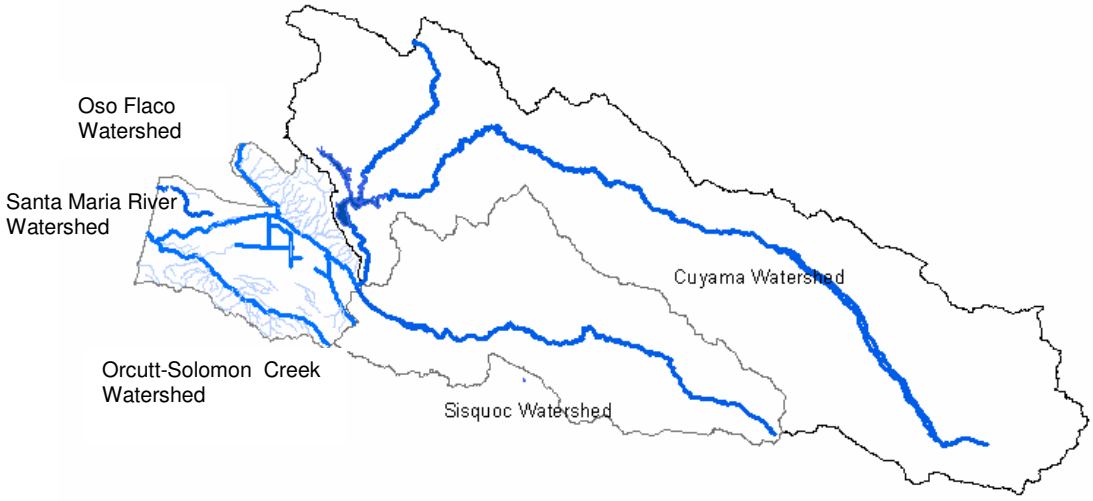

Figure 1. Major watersheds in the project area.

1.2. Listing Basis

In July 2004, the Department of Environmental Toxicology at the University of California, Davis (UC Davis) provided documentation to the State Water Resources Control Board (State Water Board) in support of placing the lower Santa Maria River on the Clean Water Act Section 303(d) List. Researchers conducted water and sediment quality studies in the Santa Maria River beginning in July 2002. This work was part of coastal river monitoring studies supported by the State Water Board and the Central Coast Regional Water Quality Control Board (Water Board). These studies found water column and sediment toxicity at two stations in the lower Santa Maria River watershed. Researchers concluded chemical analyses and associated Toxicity Identification Evaluation (TIE) studies demonstrate the toxicity was due to agricultural pesticides. These studies were consistent with previous Bay Protection and Toxic Cleanup Program (BPTCP) data demonstrating sediment and toxicity associated with elevated pesticide concentrations in the Santa Maria River estuary, and with more recent Water Board data showing elevated concentrations of pesticides in tissues of sand crabs collected at stations adjacent to the estuary. Together, these data indicated impaired beneficial uses in the lower Santa Maria River. Given the importance of this estuary as habitat for threatened and endangered fish and bird species, UC Davis recommended steps to address this impairment.

UC Davis collected samples from two stations: Orcutt Creek (312ORC), which is a tributary to the lower Santa Maria River, and Santa Maria River (312SMA). Monitoring included sediment samples for chemistry analyses, sediment toxicity tests with the amphipod *Hyalella azteca*, and TIE studies with sediment. Additionally, they collected water chemistry data, and conducted water toxicity tests with *Ceriodaphnia dubia*, and water column TIE studies.

Additionally, sediment chemistry data and a separate Water Board study that monitored pesticide concentrations in sand crabs, and the BPTCP report for supplemental sediment data supported the listing proposal.

The primary toxicity and chemistry data provided were original data from an unpublished study supported by the State Water Board and the Central Coast Water Board. Table 1 shows the results from the project, “Biological impacts from non-point source runoff to major river systems of the central California coast region”. The final report for this project was completed in March, 2005.

Additional sand crab tissue chemistry data was orginal data from a monitoring effort of coastal contaminants using sand crabs supported by the Water Board. The data was presented in a draft technical report by Dugan J., et al. (2004).

Supporting sediment chemistry and toxicity data was a part of the BPTCP by Downing J., et al. (1998): The project included an evaluation of chemistry,

toxicity and benthic community conditions in sediments of the central coast region.

Quality assurance and quality control procedures for chemistry, toxicity testing and TIEs for the primary study were identical to those used in the Surface Water Ambient Monitoring Program (SWAMP). The toxicity and chemistry laboratories participating in this study were the same labs responsible for the SWAMP Quality Assurance Project Plan (QAPP), and are the labs participating in the SWAMP program. Quality assurance and control procedures for the sand crab tissue study also followed SWAMP chemical analysis procedures. The chemistry lab used in this study was the same lab conducting organic chemical analyses for SWAMP.

Water was sampled at Orcutt Creek (312ORC) and in the Santa Maria River (312SMA) on four separate occasions (June 2002, September 2002, March 2003, and May 2003). Water was toxic at both stations in September 2002 and May 2003. Analysis of chlorpyrifos in water showed that on all occasions when water toxicity was observed, concentrations of chlorpyrifos exceeded the LC50 for this pesticide for toxicity to *Ceriodaphnia dubia*. TIEs of water samples from Orcutt Creek and the Santa Maria River showed toxicity to *C. dubia* was due to chlorpyrifos.

Sediment was sampled at Orcutt Creek (312ORC) and in the Santa Maria River (312SMA) on two separate occasions (June 2002 and May 2003). Sediment was toxic at both stations in both samples. Analysis of chlorpyrifos in sediment porewater showed that on all occasions when water toxicity was observed, concentrations of chlorpyrifos exceeded the LC50 for this pesticide to the amphipod *Hyalella ezteca*. TIEs of sediment samples from Orcutt Creek and the Santa Maria River showed toxicity was due to a combination of chlorpyrifos and other pesticides, likely pyrethroid pesticides. Sediment bulk-phase chemical analyses showed elevated concentrations of chlorpyrifos, several pyrethroid pesticides, dacthal, and DDT.

Table 1. Summary of water quality exceedances from "Biological impacts from non-point source runoff to major river systems of the central California coast region"

WQ Criterion exceeded	**GPS coordinates**	**July 8, 2002**	**September 3, 2002**	**May 28, 2003**
Orcutt Creek (312ORC)	34°57.380N 120°37.722W			
Water toxicity to C. dubia			Yes (0% survival)	Yes (0% survival)
Chlorpyrifos > LC50			Yes (6.6 TUs)	Yes (9.2 TUs)
Sediment Toxicity to H. azteca		Yes (6% survival)		Yes (0% survival)
Elevated sediment pesticides		Yes		Yes

Santa Maria River (312SMA)	34°57.618N 120°38.301W			
Water toxicity to C. dubia			Yes (0% survival)	Yes (0% survival)
Chlorpyrifos > LC50			Yes (7.6 TUs)	Yes (9.7 TUs)
Sediment Toxicity to H. azteca		Yes (6% survival)		Yes (0% survival)
Elevated sediment pesticides		Yes		Yes

TU = Toxic Unit, the measured concentration of chlorpyrifos/LC50 for chlorpyrifos toxicity to *C. dubia* (0.053 µg/L).

Concentrations of pesticides were also measured in sand crabs (*Emerita analoga*) collected at the mouth of the Santa Maria River estuary in August 2000 (Dugan et al. 2004). These samples were collected as part of a larger coastline survey in the Central Coast Region that collected sand crabs from a number of beaches. The range of sampling extended from Carpenteria Beach in Ventura County (at the southern end of the Region) to Scott Creek in Santa Cruz County (at the northern end of the Region). Concentrations of DDT in sand crab tissues at the mouth of the Santa Maria River were higher than any other site measured in the Central Coast Region, and were as high as 556 ng/g (ppb) dry wt. in samples nearest the Santa Maria River estuary. Mean concentrations of total DDT in sand crabs from the Santa Maria River area were 350 ng/g (dry wt). Results of a gradient study of tissues loads in sand crabs collected north and south of the river mouth confirmed that the Santa Maria River was the source of DDT in sand crab tissues.

These results are consistent with previous BPTCP studies that found DDT in sediments from the Santa Maria River Estuary were among the highest measured in the state (Total DDT = 679.5 µg/kg dry wt., Downing et al. 1998 Section VII). High total DDT in the sediment sample from this station corresponded with high sediment toxicity to amphipods (amphipod *Eohaustorius estuarius* mortality = 98%; Downing et al. 1998, Section II).

1.3. Applicable Water Quality Objective or Criterion

The 1995 Water Quality Control Plan (Basin Plan) for the Central Coast Region includes water quality objectives to protect beneficial uses. The general objectives for inland surface waters, enclosed bays, and estuaries that are applicable to this project are as follows:

> *All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with the objective will be determined by use of indicator organisms, analyses of species diversity, population density,*

> *growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods.*
>
> *No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.*

Federal regulations state "TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate *measure*."[Emphasis added] (40 CFR § 130.2(i)). To identify the appropriate measure, pesticide concentration levels consistent with the narrative pesticide and toxicity objectives must be identified.

Staff will also evaluate targets per guidelines for interpretation of narrative water quality objectives. The Central Valley Water Board's Policy for Application of Water Quality Objectives states that the Water Board will consider "relevant numerical criteria and guidelines developed and/or published by other agencies and organizations. When considering such criteria, the Water Board will evaluate whether the specific available numeric criteria are relevant, appropriate, and should be applied in determining compliance with the Basin Plan narrative objective."

Staff reviewed various criteria/screening values that may be used as numeric target values along with toxicity for assessing water quality within the three different categories of water column, sediment and tissue. These are as follows:

1. water column as a direct measure of water quality and to protect aquatic life and human health,
2. fish/shellfish tissue to be protective of human health for fish/shellfish consumption at the point of consumption and to be protective of ecosystem health, and
3. sediment to be protective of aquatic life.

Toxicity testing is used to assess aquatic life impairment and as a way of interpreting the narrative standard of "no toxic substances in toxic amounts."

The numeric target values for aquatic life criteria for water column and sediment are given for freshwater (salinity <= 1 ppthousand, 95% of the time) and saltwater (salinity >= 10 ppthousand, 95 % of the time) environments. Targets for brackish water (salinity between 1 and 10 ppthousand) use the more stringent freshwater or marine values, since both freshwater and saltwater species may inhabit brackish water. These definitions for salt- and freshwater come from the California Toxics Rule (CTR) (EPA, 2000, p. 31718). Based on these criteria, Table 2 lists the salinity category for the listed waterbodies.

Table 2. Listed Waterbodies and Associated Salinity Conditions.

Waterbody Name	Fresh/Salt/Brackish
Santa Maria River Estuary Lagoon (312.447, 30020)	Brackish
Santa Maria River (312SMA)	Fresh
Orcutt-Solomon (Orcutt) Creek	Fresh
Oso Flaco Creek	Fresh
Oso Flaco Lake	Fresh

Staff compared data in this report to values for organochlorine pesticides, such as DDT (total), shown in Table 3. Staff compared data to CDFG water quality criteria for chlorpyrifos and diazinon, as shown in Table 4. Staff will include tasks to evaluate UC Davis's work to develop an aquatic life criteria methodology for chlorpyrifos and diazinon in the subsequent document, the Project Plan. Staff will also include further evaluating criteria from the sources identified below to determine appropriate numeric targets.

1. Water column:
    a. California Toxic Rule (CTR) values for acute, chronic and human health for DDT, dieldrin, PCBs and toxaphene.
    b. For chlorpyrifos and diazinon, the California Department of Fish and Game's *Water Quality Criteria for Diazinon and Chlorpyrifos* (CDFG, 2000)
    c. Diazinon criteria modified based on the July 30, 2004 memorandum from California Department of Fish & Game (CDFG, 2004) to The Central Valley Regional Water Quality Control Board (CVRWQCB) that documents CDFG's reevaluation of their original work based on new information received by the CVRWQCB.
    d. Maximum seasonal concentrations necessary in streams to protect aquatic life.
2. Fish/shellfish Tissue for Human Health: the minimum value from either:
    a. California Office of Environmental Health Hazard Assessment Tissue Screening Values from the California Lakes Study (OEHHA, 1999), and
    b. EPA's Recommended Screening Values for Recreational Fishers (EPA, 2000), and
    c. FDA Action and Tolerance Levels (SWRCB, 2000).
    d. The California State Water Resources Control Board (SWRCB) Maximum Tissue Residue Levels (MTRLs)
3. Fish Tissue for Protection of Wildlife
    a. National Academy of Science Fish Tissue maximum concentrations of toxic substances in freshwater fish tissue guidelines (NAS, 1973).
4. Bottom Sediment Quality:
    a. Sediment Effects Range-Median (ERM) values developed by the National Oceanographic & Atmospheric Administration (NOAA) as informal (non-regulatory) guidelines to estimate the possible

toxicological significance of chemical concentrations in sediments (Long et al., 1998).

b. Sediment Probable Effects Levels (PELs), and marine Sediment Quality Assessment Guidelines (SQAGs) developed by the Florida Department of Environmental Protection for evaluating sediment quality conditions in Florida coastal systems (MacDonald, 1994).
c. The Threshold Effects Level (TEL) and the Effects Range - Low (ER-L), or the Upper Effects Threshold (UET) from NOAA Screening Quick Reference Tables (SQRT) (Buchman, 1999) for saltwater sediment.
d. The Threshold Effects Level (TEL) from NOAA SQRT (Buchman, 1999) for freshwater sediment.
e. New York State "Technical Guidance for Screening Contaminated Sediments (New York State, 1999, p. 24).

5. Toxicity
   Toxicity triad (toxicity test, chemistry analyses and infaunal benthic structure) to determine if a waterbody is impaired.

Table 3. Assessment Guidelines for Sediment Chemistry and Fish Tissue Bioaccumulation Data

Constituent	Sediment **ERM** (µg/Kg dry weight)	Sediment **PEL** (µg/Kg dry weight)	Tissue **MTRL** (Inland) (ug/Kg)	Tissue **MTRL** (bay/estuary) (ug/Kg)	**NAS** Whole Fish Guidelines (ug/Kg)
Aldrin			0.05	0.33	100 [2]
Chlordane (total)	6	4.79	8.0	8.3	100 [2]
p,p'-DDD	20	7.81	44.5	44.5	
p,p'-DDE	27	374	32.0	32.0	
p,p'-DDT	7	4.77	32.0	32.0	
DDT (total)	46.1	51.7			1000
Dieldrin	8	4.3	0.65	0.7	100 [2]
Endosulfan I			29700	64800	
Endosulfan II			29700	64800	
Endosulfan sulfate			29700	64800	
Endosulfan (total)					100 [2]
Endrin	45		3020	3020	100 [2]
Alpha-BHC (HCH)			0.5	1.7	
beta-BHC (HCH)			1.8	6.0	
gamma-BHC (HCH)		0.99	2.5	8.2	
Hexachlorocyclohexane (HCH, total)					100 [2]
Heptachlor			2.4	2.3	100 [2]
Heptachlor Epoxide			1.1	1.2	100 [2]
PCBs (total)	180	189	5.3	5.3	500
Toxaphene			9.6	9.8	100 [2]

[1] ERM = Effects Range-Median; PEL = Probable Effects Level; MTRL = Maximum Tissue Residue Level; NAS = National Academy of Sciences
[2] Individually or in combination. Chemicals in this group are referred to collectively as Chem A.

Table 4. CDFG criteria for diazinon and chlorpyrifos for determining toxicity in water column.

Chemical	Criterion Value	Criterion Type	Criterion Description
Diazinon	0.080 µg/L[1]	Acute	Aquatic life protection; 1-hour average; not to be exceeded more than once every 3 years, on the average
	0.050 µg/L	Chronic	Aquatic life protection; 4-day average; not to be exceeded more than once every 3 years, on the average
Chlorpyrifos	0.020 µg/L	Acute	Aquatic life protection; 1-hour average; not to be exceeded more than once every 3 years, on the average
	0.014 µg/L	Chronic	Aquatic life protection; 4-day average; not to be exceeded more than once every 3 years, on the average

[1] µg/L = micrograms per liter

In addition to the independent effects of diazinon and chlorpyrifos, staff will consider the additive impacts since the two chemicals in combination "exhibit additive toxicity when present in solutions together" (Bailey *et al.* 2000). The Central Valley Water Board's "Policy for Application of Water Quality Objectives" and the policy on "Pesticide Discharges from Nonpoint Sources" include formulas for addressing additive toxicity. Additive toxicity can be evaluated by the following from the Sacramento-San Joaquin Basin Plan (CVRWQCB, 1998):

$C_1/O_1 + C_2/O_2 + \ldots\ldots + Ci/Oi = S$ [Equation 1]

Where:

C = The concentration of each pesticide (1, 2….i) measured in a waterbody.

O = The water quality objective or criterion for the specific beneficial use for each pesticide present (1, 2,….i) based on the best available information.

S = The sum. A sum exceeding the numeric target (e.g. 0.5, 1.0) indicates that the beneficial use may be impacted.

Staff will evaluate the appropriate recommended numeric target for the additive effect of diazinon and chlorpyrifos. From Equation 1, the numeric target would be exceeded when the sum is greater than 0.5 or 1.0 (i.e. a toxic impact is occurring). The CDFG criteria in Table 4 would be the criteria used in Equation 1.

2. DATA ANALYSIS

Staff inventoried available pesticides data, including organophosphate (OP) pesticides (e.g. chlorpyrifos and diazinon), and organochlorine (OC) pesticides (e.g. DDT), and synthetic pyrethroid pesticides (e.g. permethrin, lamda cyhalothrin, esfenvalerate). This section presents the relevant data and provided a preliminary analysis of water, sediment, and tissue quality, and toxicity data in the impaired water bodies and identified important trends (e.g., spatial, temporal) in the data. The data used for listings and subsequent analysis included in this report are described in Table 5.

Staff reviewed data to address the following questions:

- What data were analyzed to evaluate the impaired water?
- What are the sources and quality of the data?
- Do the data support the listing and confirm impairment?
- Do the data illustrate any other important relationships?
- What do the data suggest about pollutant sources?

Efforts are underway to monitor flow conditions in the watershed. This analysis in the Project Definition suggested an additional evaluation of flow data to determine if there are any spatial or temporal trends (e.g., seasonal, critical conditions) or relationships (e.g., flow vs. pollutant) to support the impairment assessment and management strategy.

Efforts are also underway to monitor pesticide applications; staff will consider this information when developing the Project Plan.

2.1. Sediment, Tissue, Water Column, and Toxicity Data

Staff inventoried data and information available for the impairment assessment that provided the basis for the proposed listing (discussed previously), along with data and information developed subsequently.

Table 5 describes the data that relate to the pesticide impairment, including the project or program name, period of data collection, sample type or matrix, monitoring sites, and associated published documents and databases.

CCAMP staff is currently developing a watershed characterization for the Santa Maria Hydrologic Unit Area and will be collecting additional data in 2007-08. Staff will review and incorporate the findings and additional CCAMP data when they are available. CCAMP monitoring sites are show in Figure 2 and Figure 3.

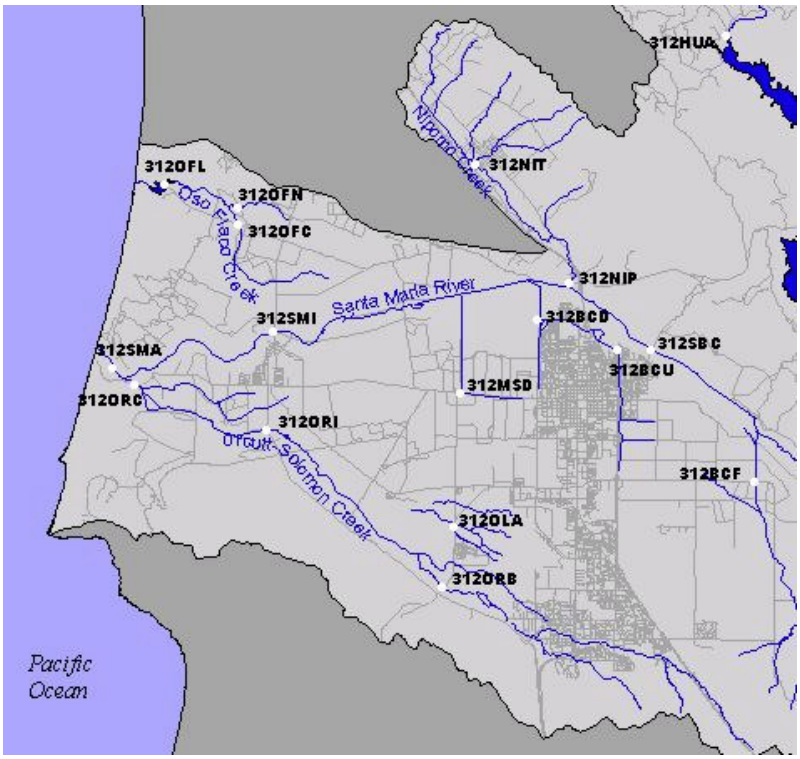

Figure 2. Watersheds, Major Water bodies and CCAMP Monitoring Locations in the Lower Santa Maria Watershed and Oso Flaco Watershed.

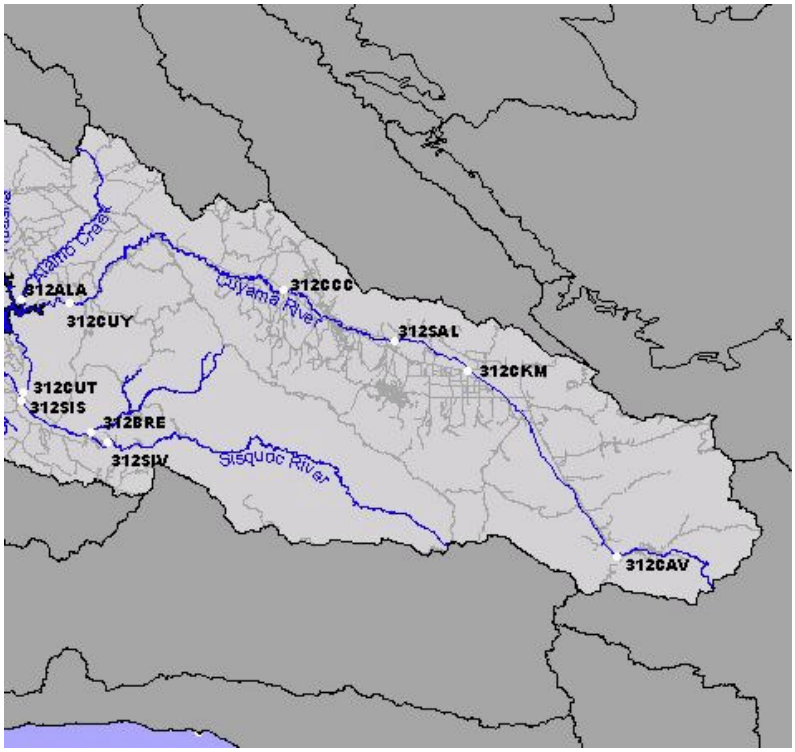

Figure 3. Watersheds, Major Water bodies and CCAMP Monitoring Locations in the Cuyama and Sisquoc Watersheds.

Table 5. Summary of tissue, water, sediment quality, and toxicity data.

Project/Program	Time Period	Sample Type/Matrix *	Sites	Documents and data
Sediment				
California Department of Fish and Game's Bay Protection Toxic Cleanup Program / CCAMP (coastal confluences project)	March, 1998	Chemistry, toxicity	Santa Maria River Estuary (30020)	Bay Protection Toxic Cleanup Program. California State Water Resources Control Board. Sacramento, CA, USA; Downing J., et al. (1998): Downing, J. *et al.* (1998); Final Report Chemical and Biological Measures of Sediment Quality in the Central Coast Region (October, 1998); Data in Report
CCAMP (5 year rotation in Santa Maria HUA)	June 2000	Pesticide Concentrations in Sediment	Santa Maria River (312SMA, 312SBC, 312SMI); Orcutt Solomon Creek (312ORC, 312ORI), Bradley Canyon Creek (312BCF), Sisquoc River (312SIS), 312SIV), Cuyama River (312CAV, 312CCC, 312CUT), Oso Flaco Creek (312OFC); Little Oso Flaco Creek (312OFN), Alamo Creek (312ALA)	Sediment Data In CCAMP database
Tissue				
California Department of Fish and Game's Toxic Substances Monitoring	1991 and 1993; August 1992; September 1999 and August 2001	Pesticide concentrations in tissue (Blue Gill; Hitch); Pesticide concentrations in tissue (resident Starry Flounder); Pesticide concentrations in tissue (Three-spined stickleback and Hitch)	Santa Maria River Mouth (312.10.00) and Oso Flaco Lake	Data in CCAMP database
California Department of Fish and Game's State Mussel Watch	February 1999, February 2000; March 2000	pesticide concentrations in muscle tissue (transplanted fresh water clam)	Santa Maria River Lagoon (312-447); Sisquoc River/Santa Maria River Mouth (312-448); Orcutt Creek/Main Street (312-448.2);	Data in CCAMP database
Sand Crab Monitoring	May and August 2000	Pesticide concentrations in	Santa Maria River estuary	Dugan J., et al. (2004). Monitoring of coastal contaminants using sand crabs.

	and February 2001	sand crab tissue (*Emerita analoga*)	(312SMRB100S)	Technical report to the Central Coast Regional Water Quality Control Board.
Water Column				
Project Clean Water	December 2002 and February 2003	Pesticide concentrations (five) in water column	Orcutt-Solomon Creek OR1 (312ORI) and OR5	Data in Clean Streams database
Toxicity				
Department of Environmental Toxicology at UC Davis; State Water Board; Central Coast Water Board	June 2002, September 2002, March 2003, and May 2003	Water Column toxicity to C. dubia; chlorpyrifos;	Orcutt-Solomon Creek (ORC) and the Santa Maria River (SMA) and watershed sites (e.g. 312MSD, 312SIV, 312ORI, 312OFC).	Data from: Agreement No. 00-114-250-0. "Biological impacts from non-point source runoff to major river systems of the central California coast region". The final report for this project was completed in March, 2005. *Evidence of pesticide impacts in the Santa Maria River watershed (Environmental Toxicology and Chemistry, 2006)*
Department of Environmental Toxicology at UC Davis; State Water Board; Central Coast Water Board	June 2002 and May 2003	Sediment Toxicity to H. azteca; chlorpyrifos in sediment porewater; Sediment bulk-phase chemical analyses (e.g chlorpyrifos, several pyrethroid pesticides, dacthal, and DDTs); TIEs	Orcutt Creek (ORC) and the Santa Maria River (SMA)	Data from: Agreement No. 00-114-250-0 (completed in March, 2005).; *Solid-Phase Sediment Toxicity Identification Evaluation in an Agricultural Stream (Environmental Toxicology and Chemistry, 2006):*
Conditional Agricultural Waiver	February, March, July, September 2005	Fish, invertebrate, algae, four water column toxicity and one sediment tocicity	CCAMP and additional watershed sites	Data in CCAMP Database
CCAMP (5 year rotation in Santa Maria HUA)	June 2000 and January-March 2007/08 (two water and one sediment)	Elisa (chlorpyrifos, diazinon) with each toxicity	Santa Maria River (312SMA and 312ORC)	Data in SWAMP

Pesticide Concentrations in Sediment

The California Department of Fish and Game BPTCP studies that found DDT in sediments from the Santa Maria River estuary were among the highest measured in the state (Total DDT = 679.5 µg/kg dry wt., Downing et al. 1998 Section VII). High total DDT in the sediment sample from this station corresponded with high sediment toxicity to amphipods (amphipod *Eohaustorius estuarius* mortality = 98%; Downing et al. 1998, Section II).

The California Department of Fish and Game BPTCP and Water Board's CCAMP staff measured pesticide concentrations in sediment in the Santa Maria River at 312SMA in March 1998 and June 2000, respectively. Sediment samples

were analyzed for numerous pesticides, including DDT, chlorpyrifos, diazinon, dieldrin, and endrin. CCAMP staff is currently performing a quality assurance evaluation of the sediment data and is developing a watershed characterization report for the Santa Maria Hydrologic Unit Area. Staff will include tasks to incorporate the results of this report including any data quality control revisions in the Project Plan.

DDT levels in 20% of samples taken at 312SMA (158 µg/Kg and 68 µg/Kg measured in 1998) were higher than the NOAA Effects Range Median (46.1 µg/Kg). Levels of p,p'-DDD, p,p'-DDE and p,p'-DDT also exceeded the criteria.

Dieldrin concentrations were also higher than the ERM (8 µg/Kg) in one sample and higher than the PEL (4.3 µg/Kg) criteria in two samples taken. Levels of chlorpyrifos and diazinon were non-detectable during both sampling events. Levels of endrin were less than the ERM criteria (45 µg/Kg). Summary statistics at 312SMA from 1998 and 2000 for DDT (total), dieldrin, and endrin are shown in Table 6. Constituents where all levels were non-detectable (e.g. PCBs) are not shown.

Table 6. Summary statistics of sediment data (µg/Kg) collected at 312SMA in the Santa Maria River in 1998 and 2000.

312SMA	count	max	min	median	average
p,p'-DDD	4	34.9	ND	9.3	13.3
p,p'-DDE	4	76.7	ND	24.0	31.2
p,p'-DDT	4	46.5	ND	14.2	18.7
DDT_TOT	5	158.1	3.5	15.0	50.6
DIELD	4	14.4	ND	3.6	5.4
ENDRN	3	6.0	2.4	2.6	3.7

CCAMP staff measured pesticide concentrations in sediment in the Santa Maria River at 312SMI in June 2000. (Duplicate samples were taken in 2000 at 312SMI and 312SMA for quality assurance purposes.) Concentrations measured in 2000 of DDT, dieldrin, and endrin (µg/Kg) are shown in the table below. Concentrations measured in 2000 at 312SMA are shown in Table 7 to compare levels measured upstream at 312SMI to downstream at 312SMA.

DDT total concentrations were higher at 312SMI than downstream at 312SMA, but were lower than the ERM (46.1 µg/Kg) and the PEL (51.7 µg/Kg) at both sites. Levels of p,p'-DDT at 312SMA (8.3 µg/Kg) were higher than the ERM (7 µg/Kg) and the PEL (4.77 µg/Kg) in one sample.

Levels of dieldrin were slightly higher at 312SMI (4.5 µg/Kg) than the PEL criteria (4.3 µg/Kg) in one of two samples taken. Levels of endrin were below criteria. Levels of chlorpyrifos and diazinon were non-detectable. Constituents where all levels were non-detectable are not shown.

Table 7. Summary statistics of sediment data (µg/Kg) collected at 312SMA and 312SMI in the Santa Maria River in 2000.

312SMA	count	max	min	median	average
p,p'-DDD	2	3.5	ND	1.8	1.8
p,p'-DDE	2	15	ND	7.5	7.5
p,p'-DDT	2	8.3	ND	4.2	4.2
DDT_TOT	3	15	3.5	8.3	8.9
DIELD	2	0.97	ND	0.485	0.485
ENDRN	1	2.4	2.4	2.4	2.4
312SMI	**count**	**max**	**min**	**median**	**average**
p,p'-DDD	2	3.1	ND	1.55	1.55
p,p'-DDE	2	40	ND	20	20
p,p'-DDT	2	.043	ND	.0215	.0215
DDT_TOT	3	43	3.1	40	28.7
DIELD	2	4.5	ND	2.25	2.25
ENDRN	2	13	ND	6.5	6.5

In addition, CCAMP staff measured pesticide concentrations in sediment in tributaries to the Santa Maria River in June 2000. Concentrations of DDT, dieldrin, and endrin are shown in Table 8. (Duplicate samples were taken in 2000 at 312SIV for quality assurance purposes).

DDT total (65.7 µg/Kg) measured at 312ORC exceeded the ERM (46.1 µg/Kg) and the PEL (51.7 µg/Kg). In addition, p,p'-DDD, p,p'-DDE, and p,p'-DDT concentrations at 312ORC exceeded the criteria. Constituents where all levels were non-detectable (e.g PCBs, diazinon) or below reporting limits (e.g. chlorpyrifos) are not shown. This analysis indicated additional review of the data was needed to evaluate the impairment of each of the water bodies.

Table 8. Sediment data (µg/Kg) collected at various sites in the Santa Maria River watershed in 2000.

Site	p,p'-DDD	p,p'-DDE	p,p'-DDT	DDT_TOT	DIELD	Endrin
312ALA	ND	ND	ND	ND	ND	ND
312BCF	1.2	7.2	3.7	12.1	1.5	ND
312CAV	ND	ND	ND	ND	ND	ND
312CCC	ND	ND	ND	ND	ND	ND
312CUT	ND	0.82	ND	0.9015	ND	ND
312ORC	8.7	38	19	65.7	1.8	6.3
312SBC	.46	3.6	1.8	5.9	ND	ND
312SIS	1.3	8.6	8.5	18.4	0.36	1.1
312SIV	ND,ND	0.21,ND	ND,ND	ND,ND	ND,ND	ND,ND

CCAMP staff also measured concentrations in Little Oso Flaco Creek in June 2000. Table 9 shows summary statistics in µg/Kg (duplicate samples were taken.) All constituents (e.g. chlorpyrifos, diazinon, p,p'-DDD, p,p'-DDE, and p,p'-DDT not shown) fell below the criteria.

Table 9. Summary statistics of sediment data (µg/Kg) collected at 312OFN in Oso Flaco Creek in 2000.

312OFN	count	max	min	median	average
DDT_TOT	3	5.3	0.97	3	3.09
DIELD	2	2.6	ND	1.3	1.3
ENDRN	2	1.4	ND	0.7	0.7

Pesticide concentrations in tissue

Staff evaluated tissue data collected by the Toxic Substances Monitoring (TSM) program from the Santa Maria River in 1992 and data collected by the State Mussel Watch (SMW) program from the Santa Maria River and Orcutt-Solomon Creek in 1999 and 2000. Staff combined data collected at SMR Lagoon (312-447), SMR Mouth (312-448), and Santa Maria River (312.10.00) as these sites represent the same contributing area and have similar tidal conditions. Table 10 show summary statistics for data collected in the Santa Maria River Estuary and Table 11 shows data collected in Orcutt-Solomon Creek (µg/Kg). Constituents where all levels were non-detectable are not shown.

Staff found elevated levels of aldrin, total DDT, p,p'-DDD, p,p'-DDE, and p,p'-DDT, dieldrin, endrin, and toxaphene in the Santa Maria River and elevated levels of p,p'-DDE and p,p'-DDT, dieldrin, and toxaphene in Orcutt-Solomon Creek when compared to tissue criteria.

Table 10. Summary statistics of tissue data (µg/Kg) collected in the Santa Maria River and Estuary in 1992, 1999 and 2000.

constituent	count	max	min	median	average
Aldrin	5	0.2	ND	ND	0.04
Chlordane, cis	5	1.4	ND	0.4	0.6
Chlordane (total)	5	5.4	ND	1.5	2.2
p,p'-DDD	6	34355.8	3.2	62.7	62.7
p,p'-DDE	6	110429.4	27.4	255.5	230.75
p,p'-DDT	6	58895.7	2.9	108.3	99.15
DDT (total)	5	220,433.3	37.1	527.3	44,994.9
DIAZN	5	19.3	ND	ND	3.9
DIELD	5	4,785.3	1.2	22.4	979.9
Endrin	5	6,135	ND	7.6	1,248.5
Toxaphene	5	147,239.3	ND	910.00	30,260.1

Table 11. Tissue data (µg/Kg) collected in Orcutt-Solomon Creek in 2000.

constituent	Concentration (ppb)
Chlordane, cis	1.4
Chlordane (total)	4.8
p,p'-DDD	35.1
p,p'-DDE	242
p,p'-DDT	93.6
DDT (total)	422.5
DIELD	36.5
Toxaphene	725.9

Concentrations of pesticides were also measured in sand crabs (*Emerita analoga*) collected at the mouth of the Santa Maria River estuary in August 2000 (Dugan et al. 2004). As mentioned, concentrations of DDT in sand crab tissues at the mouth of the Santa Maria River were higher than any other site measured in the Central Coast Region. Staff reviewed data collected at the Santa Maria River Estuary (312SMRB) and found that 100% of total DDT values and 50% of dieldrin values were higher than the criteria shown previously. Staff will consider further evaluating the chemical concentrations (e.g. chlorpyrifos, PCBs) when developing the Project Plan.

Chemical concentrations were also measured south of Oso Flaco Beach at 312GB. Staff will also consider further evaluating a potential relationship between the listed waterbodies and this site when developing the Project Plan. This analysis also suggested an evaluation of wet weight values in addition to dry weight values is needed.

Resident fish were also collected at two sites by California Department of Fish and Game staff working with the Toxic Substances Monitoring Program. Three-spined stickleback (*G. aculeatus*) was collected at Santa Maria River lagoon in September 1999 and Hitch (*L. exilicauda*) was collected at Oso Flaco Lake in August 2001. Hitch and Bluegill were also collected in 1991 and 1993 respectively. The results of this analysis indicated that further evaluation of fish tissue data (including chemical concentrations, such as eldrin and dieldrin) is needed to support the impairment assessment and management strategies. Staff will include these tasks in the Project Plan.

Pesticide Concentrations in Water

The County of Santa Barbara Project Clean Water staff measured pesticide concentrations in storm water flows from two sites in Orcutt-Solomon Creek in December 2002 and February 2003. All samples taken at the furthest downstream site (OR1) had non-detectable levels of pesticide concentrations. The data collected at OR5 is shown in Table 12 (in µg/L). Concentrations of chlorpyrifos, diazinon, and malathion were detected. The concentration of chlorpyrifos was higher than the CDFG acute and chronic water quality criteria

(0.020 µg/L and 0.014 µg/L). Diazinon was lower than the CDFG acute water quality criteria (0.080 µg/L) but higher than the CDFG chronic water quality criteria (0.050 µg/L). Malathion was detected at OR5, but staff did not have criteria in which to compare the data.

Table 12. Summary statistics of water column data collected at OR5 (µg/L) in Orcutt-Solomon Creek in 2002 and 2003.

Parameter	**Site**	**12/16/2002**	**2/12/2003**
Chlorpyrifos	OR5	0.07	ND
Demeton	OR5	ND	ND
Diazinon	OR5	0.06	0.04
Malathion	OR5	0.2	ND
Parathion	OR5	ND	ND

Evidence of pesticide impacts

UC Davis, the Water Board and the State Water Board, conducted monitoring which supported the initial listing proposal. This information was published in a paper titled "Evidence of pesticide impacts in the Santa Maria River watershed" (Environmental Toxicology and Chemistry, 2006). The following information is from the paper:

The Santa Maria River provides significant freshwater and coastal habitat in a semi-arid region of central California. UC Davis conducted a water and sediment quality assessment consisting of chemical analyses, toxicity tests, toxicity identification evaluations, and macroinvertebrate bioassessments of samples from 6 stations collected during 4 surveys. Santa Maria River water samples collected downstream of Orcutt Creek, which conveys agriculture drainwater, were acutely toxic to cladocera *(Ceriodaphnia dubi*a), as were samples from Orcutt Creek. TIEs suggested that toxicity to *C. dubia* in Orcutt Creek and the Santa Maria River was due to chlorpyrifos. Sediments from these two stations were also acutely toxic to the amphipod *Hyalella azteca*, a resident invertebrate. TIEs conducted on sediment suggested that toxicity to amphipods was due in part to organophosphate (OP) pesticides. Concentrations of chlorpyrifos in porewater sometimes exceeded the 10-d median lethal concentration for *H azteca*. Additional TIE and chemical evidence suggested sediment toxicity could also be partly due to pyrethroid pesticides. Relative to an upstream reference station, macroinvertebrate community structure was impacted in Orcutt Creek and in the Santa Maria River downstream of the Creek input. This study suggested that pesticide pollution is the likely cause of ecological damage in the Santa Maria River.

Staff will include a task to incorporate the results of TIEs conducted at additional sites throughout the Santa Maria and Oso Flaco watersheds that may have indicated toxicity (e.g. 312MSD, 312SIV, 312ORI, 312OFC) in the Project Plan to support the management strategy.

Solid-phase sediment TIEs

UC Davis, the Water Board and the State Water Board, also found that pyrethroid and OP pesticides were responsible for sediment toxicity in Orcutt Creek. The following information was published in an article titled *Solid-Phase Sediment Toxicity Identification Evaluation in an Agricultural Stream* (Environmental Toxicology and Chemistry, 2006):

The lower Santa Maria River watershed provides important aquatic habitat on the central California coast and is influenced heavily by agricultural runoff. As part of a recently completed water quality assessment, researchers conducted a series of water column and sediment toxicity tests throughout this watershed. Sediment from Orcutt Creek, a tributary that drains agricultural land, consistently was toxic to the amphipod *Hyalella azteca*, which is a resident genus in this river. TIEs were conducted to determine cause(s) of toxicity. We observed no toxicity in sediment interstitial water even though concentrations of chlorpyrifos exceeded published aqueous toxicity thresholds for *H. azteca*. In contrast to interstitial water, bulk sediment was toxic to *H. azteca*. In bulk-phase sediment TIEs, the addition of 20% (by volume) coconut charcoal increased survival by 41%, implicating organic chemical(s). Addition of 5% (by volume) of the carbonaceous resin Ambersorb 563t increased survival by 88%, again suggesting toxicity due to organic chemicals. Toxicity was confirmed by isolating Ambersorb from the sediment, eluting the resin with methanol, and observing significant toxicity in control water spiked with the methanol eluate. Acarboxylesterase enzyme that hydrolyzes synthetic pyrethroids was added to overlying water, and this significantly reduced toxicity to amphipods.

Although the pesticides chlorpyrifos, DDT, permethrin, esfenvalerate, and fenvalerate were detected in this sediment, and their concentrations were below published toxicity thresholds for *H. azteca*, additivity or synergism may have occurred. The weight-of evidence suggests toxicity of this sediment was caused by an organic contaminant, most likely a synthetic pyrethroid.

Staff will consider incorporating results of TIEs conducted at additional sites throughout the Santa Maria and Oso Flaco watersheds that may have indicated sediment toxicity (e.g. 312MSD, 312SIV, 312ORI, 312OFC) in the Project Plan.

Water Toxicity in the Santa Maria River watershed

CCAMP staff performed Enzyme-linked immunosorbant assays (ELISA) at 312SMA and 312ORC for chloropyrifos and diazinon with each toxicity test. An evaluation was conducted in June 2000 and additional evaluations (two water and one sediment) are planned between January 2007 and March 2008.

Staff conducted a preliminary evaluation of the data. Data indicated water column toxicity at station 312ORI and sediment toxicity at stations: 312MSD, 312BCF, 312ORC, and 312SMA. CCAMP staff is currently developing a report of findings; staff will include a task to review these results in the Project Plan.

Toxicity Testing in the Santa Maria River watershed

Monitoring for the Conditional Agricultural Waiver Program included toxicity testing, with follow-up pesticide monitoring. The Conditional Agricultural Waiver Program's Coordinated Monitroing Program (CMP) sites include many existing CCAMP sites, and a few additions. The Santa Maria estuary site (312SMA) showed significant sediment and water column toxicity. Results were as follows:

- 58% of all water samples taken from the southern sites showed significant toxicity, and 90% of all sediment samples showed significant toxicity.
- Two sites out of ten showed 100% water column toxicity every time they were sampled, and both those sites showed 100% sediment toxicity (Bradley channel at Jones St and Green Valley).
- All sites showed significant water column toxicity at least once. All sites (except for Bradley canyon at culvert) showed significant sediment toxicity.
- 85% of the time samples showed significant water column toxicity, they were 100% toxic.
- 44% of the time samples showed significant sediment toxicity, they were 100% toxic.

As part of the first phase of CMP follow-up monitoring, growers will be testing for OP pesticide concentrations (and calculating loads). Staff will evaluate if chlorpyrifos and diazinon concentrations are high enough to account for toxicity. Staff will evaluate the July 2006-July 2007 data and determine if additional monitoring (e.g. TIEs) is necessary. Staff will consider the new information in developing the Project Plan.

2.2. Flow Data

The water bodies in the project area are characterized by extremely low flows, particularily during the dry season.

CMP staff monitor flow on a monthly basis at each site. CCAMP staff also collects flow data on a monthly basis as of January 2005 at 312SMA. Watershed monitoring beginning in January 2007 will also include flow monitoring at all CCAMP sites.

Additional analyses of flow data will be needed to determine if there are any spatial or temporal trends in flow (e.g., seasonal) or relationships (e.g., flow vs. pollutant). This task will be included in the Project Plan.

2.3. Pesticide Use Data

There are tracking efforts occurring as a result of in place regulatory mechanisms, including the Department of Pesticide Regulation's Pesticide Use Reports (PURs) of pesticides such as chlorpyrifos and diazinon. Staff will consider evaluating PURs in developing the project plan.

2.4. Preliminary Summary and Analysis Strategy

Staff evaluated available tissue, sediment, water column and toxicity data. The analysis confirmed impairment of the Santa Maria Estuary and Orcutt-Solomon Creek. Data also suggested impairment of the Santa Maria River including some contributing drainages, and waterbodies in the Oso Flaco watershed.

Constituents of concern included organochlorine (OC) pesticides (aldrin, p,p'-DDD, p,p'-DDE, and p,p'-DDT, dieldrin, endrin, and toxaphene); organophosphate (OP) pesticides (chlorpyrifos, and diazinon); and synthetic pyrethroid pesticides.

As a result of the Project Definition analyses, additional analyses and potentially additional data to evaluate the relationships (between specific land uses and pollutant loading, and flow and pollutant loading, and chemical concentrations and toxicity) in each of the impaired water bodies are needed.

2.5. Initial Source Assessment

Staff evaluated the known and expected key sources in the watershed. The primary source appeared to be agricultural application of pesticides. Residential uses (e.g. for landscaping and urban structural termite control) may also have contributed to the impairment. Implementation actions will likely focus on agricultural and urban areas.

Researchers at UC Berkeley are in the process of determining contributions of different pyrethroids from urban and agricultural environments and associated sediment toxicity. Staff will consider these results in developing the Project Plan. Additional information (e.g. toxicity, tissue, sediment data) regarding the relative contributions of the pollutants of concern from agricultural and urban areas may be needed to assess the impairment and determine implementation actions.

Use cancellations and restrictions have influenced potential source contributions. These are discussed below.

Use cancellations and restrictions

Since 2001, the USEPA has mandated diazinon and chlorpyrifos use cancellations (phase-outs) and restrictions for urban and agricultural uses (USEPA Diazinon and Chlorpyrifos Interim Reregistration Eligibility Decisions (IREDs)). The USEPA has undertaken the reregistration process for diazinon and chlorpyrifos to ensure that the pesticides meet the safety standards under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Food Quality Protection Act of 1996. Under the IREDs, outdoor urban residential and commercial uses of diazinon will be eliminated. Most urban uses of chlorpyrifos will either be eliminated or severely restricted. Many of the other proposed diazinon and chlorpyrifos use restrictions and cancellations apply to agricultural uses. Substantial reduction of chlorpyrifos use in the urban environment and total elimination of diazinon use in the urban environment are expected to facilitate diazinon and chlorpyrifos concentration reductions in impaired waterways. The IREDS for specific agricultural sites of use are in a public review and comment period.

OC pesticides and PCBs are often called historic or legacy pollutants, since concentrations of these chemicals persist in the environment despite enactment of regulations to restrict and/or end their use. All but two (dacthal and endosulfan) have been banned from use and manufacture in the United States, as shown in Table 13. The unique properties that contribute to the effectiveness of these chemicals as pesticides and industrial products have also contributed to their tendency to persist in soils and sediment, concentrate in biota, and bioaccumulate.

Table 13. Use History of OC Pesticides and PCBs in the United States (shading indicates time period of legalized use).

CONSTITUENT	1925 - 1929	1930 - 1934	1935 - 1939	1940 - 1944	1945 - 1949	1950 - 1954	1955 - 1959	1960 - 1964	1965 - 1969	1970 - 1974	1975 - 1975	1980 - 1984	1985 - 1989	1990 - 1994	1995 - 1999	2000 - 2004
Chlordane					1948								1988			
Dacthal							1958									
DDT			1939								1972					
Dieldrin/Aldrin					1948								1987			
Endosulfan						1954										
Endrin						1951								1991		
Heptachlor						1952							1988			
HCH/Lindane					1945											2002
PCBs	1929										1979					
Toxaphene					1945									1990		
Dicofol [1]							1957									

[1] Dicofol is not included on the 303(d) list for the CCW, but does contain trace amounts of DDT.

In September 2006, U.S. EPA proposed a stipulation regarding the impacts of 66 pesticides to the California red-legged frog. Staff will include the status of the proposed ban associated with red-legged frog habitat in subsequent documents.

Management Techniques

Staff evaluated potential management practices that might be required to improve water quality. The impairment will likely be resolved (including monitoring and reporting) by implementing the Water Board's agricultural waiver and urban storm water programs, along with existing implementation of management measures, tracking mechanisms, and cancellations and restrictions. Land management activities occurring within the watershed have negatively impacted water quality. Implementation of the agricultural waiver and urban storm water management plans which include measures to reduce pesticide use and/or transport will lead to improved water quality.

3. PROJECT MANAGEMENT

3.1. Project Objectives and Recommended Approach

This project's objectives are to develop pesticide TMDLs and an Implementation Plan that will satisfy the requirement pursuant to Section 303(d) of the Clean Water Act to attain water quality standards and protect beneficial uses for the listed water bodies. Staff recommends that TMDLs, including numeric targets, allocations, and implementation and monitoring actions be developed.

The project scope will be the impaired waterbodies for the constituents of concern. Staff will develop subsequent documents (e.g. Project Charter, Project Plan, Data Analysis Report, Preliminary Project Report, Final Report, etc…). Staff will evaluate 2007-08 CCAMP data and additional CMP data when the project commences.

3.2. Working Hypothesis Regarding the Causes of Impairment

Researchers found water and sediment toxicity in the lower Santa Maria watershed. Chemical analyses and TIEs suggested that water toxicity in Orcutt Creek and the lower Santa Maria River (downstream of the confluence with Orcutt Creek) was due to chlorpyrifos. Additionally, similar evidence showed OP pesticides (chlorpyrifos) and pyrethroid pesticides caused sediment toxicity in Orcutt Creek and the lower Santa Maria River. It was likely the impacts from sediment toxicity were additive because the multiple contaminants present (pyrethroid and OP pesticides) had levels of individual contaminants below

published toxicity thresholds. Orcutt Creek appeared to be the major source of toxicity to the Santa Maria River Estuary. Bioassessments showed declines in macroinvertebrates at the same stations with toxicity and high pesticide concentrations. DDT in sediments from the Santa Maria River estuary were among the highest measured in the state. Pesticide pollution was the likely cause of ecological damage in the Santa Maria River.

The likely causes of the impairment appeared to be agricultural application of pesticides and residential uses (e.g. for landscaping and urban structural termite control).

3.3. Project Stakeholders

Staff will identify key stakeholders for the project during preparation of the Project Plan and Project Charter. Key stakeholders will include agricultural and urban interests, similar to those that participated in the Nitrate and Fecal Coliform TMDLs. Staff recommends developing a Stakeholder Plan for this project.

Project Approval Sign-Off

Staff will bring the project to the Water Board, State Board, OAL, and USEPA for approval. In addition to formal approval, stakeholder buy-in is important to successful approval and implementation. Staff will engage stakeholders early, during the Project Planning Phase to ensure successful public involvement.

3.4. Project Characteristics

Assumptions

The proposed pesticide listings will be included on the 2006 Section 303(d) list of impaired water bodies.

Constraints

Additional information may be needed to better understand the relative contribution from agricultural and urban sources to determine an appropriate management strategy.

Staff has asserted and State Board is expected to adopt a defined schedule for this project with a new adoption date in the revised 303(d) list. Staff recommends continuing the project (as it has high priority due to the severity of conditions) and completing within the specific time frame of 2 years, depending on continued resource allocation.

Issues

The success of this project depends on maintaining current regional regulatory priorities, allocating appropriate amount of resources, and managing risks that may affect the schedule (including concerns that are outside the control of the Water Board).

Related/Dependant Projects

This project is being initiated following various data collection efforts and studies (pesticides, toxicity, and bioassessments). CCAMP staff is currently developing a watershed characterization for the Santa Maria Hydrologic Unit Area. Staff will review this report and incorporate the 2007-08 CCAMP data when they are available.

This project is being developed in parallel with implementation of various management measures. Additionally, use restrictions and cancellations are critical to reduce and eliminate certain pesticides, particularly DDT. The success of this project is dependant upon these efforts.

Project implementation and monitoring will likely rely on two of the Water Board's existing regulatory mechanisms - urban storm water permits and agricultural waivers (e.g. implementation of measures to manage application and reduce off-site movement of pesticides, integrated pest management practices) and watershed monitoring programs – CMP and CCAMP.

Tracking efforts are occurring as a result of in place regulatory mechanisms, including the Department of Pesticide Regulation's Pesticide Use Reports (PURs) of pesticides such as chlorpyrifos and diazinon. Source assessment and tracking of implementation will rely on this reporting mechanism.

The fecal coliform and nitrate TMDL projects for this watershed are already underway; staff has developed Draft (nitrate) and Final (fecal coliform) Preliminary Project Reports for these constituents. Staff will build on knowledge gained (related to the project area, key stakeholders, etc…) to develop the TMDLs.

Staff will also rely on methods used and knowledge gained from other pesticide TMDLs in the Central Coast Region and in other Regions (including San Francisco, Los Angeles, and Central Valley) and from other entities (e.g. UC Berkeley's work to evaluate toxicity and pyrethroids, UC Davis's work to develop an aquatic life criteria methodology for chlorpyrifos and diazinon.)

Critical Success Factors

Key areas in which favorable results are necessary for the project to reach its goals include: organizational support and stakeholder buy-in.

Resources and Additional Investigation

Personnel possessing technical skills, capabilities, and competencies in scientific disciplines (e.g. hydrology, toxicology, ecology, statistics), along with knowledge

of regulatory mechanisms and approaches are necessary for this project. In addition to technical Project Personnel, this project requires internal program collaboration, and management and executive support in order to be successfully completed.

This Project Definition analysis suggested that additional analyses and potentially additional data are needed to further understand the relationships (between specific land uses and pollutant loading, and flow and pollutant loading, and chemical concentrations and toxicity) in each of the impaired water bodies. Staff will include tasks to review additional existing data mentioned in this report (e.g. sediment, toxicity, fish tissue data) and further characterize the extent of impairment from specific constituents (e.g. dieldrin in Oso Flaco Lake, endrin in the Santa Maria River) in the Project Plan. CCAMP staff plans to conduct additional sediment chemistry monitoring in 2006-07. Staff will work with CCAMP staff in determining which sites (e.g. new sites to differentiate agricultural and urban contributions, and/or existing CCAMP sites to increase sample size: 312OFN, 312SMI, 312SMA, 312ORC, 312BCF, 312SIS, 312MSD) to include in the effort.

Staff recommends that TMDLs be developed for the impaired water bodies. As such, a Project Charter, Project Plan, Data Analysis Report, and subsequent Project Report documents should be developed to address the impairment.